

AMENDMENTS TO THE SPECIFICATION

Please amend the paragraph beginning on page 6, line 6, to read as follows:

FIGURES 6(a) to ~~6(m)~~ 6(n) illustrate amplitude spectra of the reproduced signals at a listener's ears, for different spacings of a loudspeaker pair.

Please amend the paragraph beginning on page 25, line 5, to read as follows:

For the three loudspeaker spans 60° , 20° , and 10° , this approximation gives the three values 1.8kHz, 5.4kHz, and 10.8kHz of f_o (rule of thumb: $f_o \approx 100\text{kHz}$ divided by loudspeaker span in degrees) which are in good agreement with the exact values. It is seen that f_o tends to infinity as θ tends to zero, and so in principle it is possible to make f_o arbitrarily large. In practice, however, physical constraints inevitably imposes an upper bound on f_o . It can be shown that the in limiting case is as θ tends to zero, ~~[[she]]~~ the sound field generated by the two point sources is equivalent to that of a point monopole and a point dipole, both positioned at the origin of the co-ordinate system.

Please amend the paragraph beginning on page 28, line 25, to read as follows:

The virtual source imaging problem is illustrated in ~~FIGURE 8a~~ FIGURE 8b. We imagine that a monopole source is positioned somewhere in the listening space. The transfer functions from this source to the listener's ears are of the same type as C_1 and C_2 , and they are denoted by A_1 and A_2 . As in the cross-talk cancellation case, it is convenient to normalise the desired signals in order to ensure causality of the source inputs. The desired signals are therefore defined as $D_1 = DC_1 A_1 / A_2$ and $D_2 = DC_1$. Note that this definition assumes that the virtual source is in the right half plane (at a position for which $x_1 > 0$). As in the cross-talk cancellation case, the source inputs can be calculated by solving $Cv = d$ for v , and the time domain responses can then

be determined by taking the inverse fourier transform. The result is that each source input is now the convolution of D with the sum of two decaying trains of delta functions, one positive and one negative. This is not surprising since the sources have to reproduce two positive pulses rather than just one. Thus, the 'positive part' of $v_1(t)$ combined with the 'negative part' of $v_2(t)$ produces the pulse at the listener's left ear whereas the 'negative part' of $v_1(t)$ combined with the 'positive part' of $v_2(t)$ produces the pulse at the listener's right ear. This is illustrated in FIGURES 12a, 12b and 12c. Note again that when $\theta = 10^\circ$, the two source inputs are very nearly equal and opposite.

Please amend the paragraph beginning on page 29, line 16, to read as follows:

~~FIGURES 11a etc~~ FIGURES 12a etc show the source inputs equivalent to those plotted in FIGURE 9a etc (three different loudspeaker spans θ : 60° , 20° , and 10°), but for a virtual source imaging system rather than a cross-talk cancellation system. The virtual source is positioned at (1m,0m) which means that it is at an angle of 45° to the left relative to straight front as seen by the listener. When θ is 60° (FIGURE 12a), both the positive and the negative pulse trains can be seen clearly in $v_1(t)$ and $v_2(t)$. As θ is reduced to 20° (FIGURE 12b), the positive and negative pulse trains start to cancel out. This is even more evident when θ is 10° (FIGURE 12c). In this case the two source inputs look roughly like square pulses of relatively short duration (this duration is given by the difference in arrival time at the microphones of a pulse emitted from the virtual source). The advantage of the cancelling of the positive and negative parts of the pulse trains is that it greatly reduces the low-frequency content of the source inputs, and this is why virtual source imaging systems in practice are much easier to implement than cross-talk cancellation systems.